THE GEOLOGY OF THE MOON CREEK MAP-AREA WEST-CENTRAL ALBERTA

BY

ERNEST JAMES WINGETT IRISH

B.A., University of British Columbia, 1939
M.A., University of British Columbia, 1940

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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Introduction

Before 1944, little geological work had been done in the Foothills region between Athabaska and Smoky Rivers. In 1910 and 1911, D. B. Dowling (1) studied the coal deposits of Jasper Park and published brief descriptions of the formations near Brûlé Lake and Moosehorn Creek. In 1916, J. M. MacVicar (9) examined the coal occurrences between Brûlé and Smoky River. James McEvoy (10) made an examination of the Smoky River coal field about 1924, and B. R. MacKay (8) made a detailed study of the Brûlé coal deposits in 1929. More recently, areas north of Athabaska River have been mapped by A. H. Lang (4) (5) (6) (7), and by E. J. W. Irish (2) (3).

The geologic study and mapping of Moon Creek map-area was begun during the summer of 1946 and completed during the summer of 1947. Most of the work was done by pacing distances along compass bearings from fixed points and by ascertaining differences in elevation with an aneroid barometer. A plane-table with telescopic alidade was used for locating points more accurately, and the use of vertical aerial photographs facilitated the work. The geology was plotted on a topographic map printed on a scale of 1 inch to ½ mile.

The area is situated north of Athabaska River valley and comprises 185 square miles of the Foothills Belt of western Alberta between latitudes 53° 30′ and 53° 45′ and longitudes 118° 15′ and 118° 30′. The nearest store, post office and telegraph service are 70 miles to the southeast at Entrance, a village located on the Canadian National Railway 190 miles west of Edmonton, Alberta.

Topography

The map-area is occupied mainly by typical foothills consisting of northwesterly-trending ridges and valleys. The ridges are usually rounded and, where not burned, are timbered to, or nearly to, the top. A northwesterly extension of the Boule Range crosses the area from southeast to northwest forming a strip of rugged, mountainous country about 5 miles wide. Relief changes gradually from a few tens of feet in the northeastern part of the area to a maximum of 3,000 feet near the mountains. Some peaks have altitudes that exceed 8,600 feet. Timber-line occurs at 6,000 feet above sea-level.

The district has reached a stage of topographic maturity with well-defined drainage systems. The principal streams flow northeasterly in wide, glaciated valleys that cross-cut the structural trend. The upland slopes have been modified by ice which formed cirques, cols, arretes, and deposited morainal material in the stream valleys.

Geology

Stratigraphy

The map-area is underlain by marine and non-marine sedimentary strata ranging in age from Devonian to Paleocene. These strata have been deformed by intense folding along northwesterly-trending axes, and by strike thrust faults which parallel the axes of the folds. Structural deformation increases progressively southwestward toward the mountains. The formations are exposed in long, relatively narrow, northwesterly-trending bands due to the erosion of the folded and faulted strata.

Exposurers of Palaeozoic strata are confined entirely to the mountainous belt, lower Mesozoic formations occur mainly on the flanks of the mountain zone, Lower Cretaceous formations occupy the region southwest of the mountains, and both Upper and Lower Cretaceous strata underlie the area to the

northeast of the mountains.

Structure

All faults are considered to be strike faults along which the strata have been overthrust from the southwest to the northeast. The two principal thrusts in the area form two fault blocks that have brought to the surface the relatively more competent Palaeozoic limestone which now forms the mountainous belt. Other large and numerous minor thrusts are present. It is known that some of the smaller faults die out downward in bedding planes.

In Moon creek area most of the anticlines and synclines are asymmetrical with their northeast limbs dipping steeply to the northeast. The anticlines, which usually form the ridges, are relatively narrow and compressed with brecciated cores, whereas the synclines are broader and more open. In some places the anticlines have been thrust northeastward so as to partially override the adjacent syncline. The major anticlinal folds are supported by the massive Palaeozoic limestone, but the maximum amount of folding and crumpling occurs in the less competent strata. Drag folds are common in the regions in front of the major overthrusts.

Two intersecting, usually steeply-dipping, sets of joints are present throughout the area. One set is approximately parallel with the regional strike of the structure and the other is nearly normal to this strike, both sets tending to be perpendicular to the bedding planes. It is concluded that lithology is the decisive factor in the spacing of both joint sets and that, probably, both of these joint sets are genetically related to the regional stress.

The hypothesis of origin for the structures of Moon Creek area has been based on the assumptions that compressive stress acting in the crust caused shearing and a northeastward movement of the sediments from the geosyncline relative to the basement complex, and that a surface of parting or shear existed between the Palaeozoic sediments and the Pre-

Cambrian rocks.

It has been postulated that relative movement of the sediments from the geosyncline increased progressively as the distance above the basement rocks increased, this differential movement causing the formation of asymmetrical and overturned folds. The major structures are thought to have been controlled and localized by the massive, Palaeozoic limestone formations which reacted toward the stress as a competent series while the Mesozoic strata reacted toward the stress as an incompetent series.

A forward "rolling up" motion of the major anticlines caused intense compression in the steeper limb of the adjacent syncline; this compression being relieved by a combination of bedding-plane slippage, shearing and crumpling. Shear planes were developed mainly on the gentler limb of the syncline and the position of each was dependent on the locus of curvature of the syncline. The minor folds and faults in the Mesozoic strata were controlled and localized by more competent sandstone members acting as struts, and these structures may be indepenednt of underlying structures in the Palaeozoic strata.

The processes of folding and faulting are considered to have taken place as continuous and overlapping events which occurred during a long period of time.

Large reserves of high grade, bituminous coal are present in the area. Oil and gas possibilities have not yet been tested.

BIBLIOGRAPHY

1. Dowling, D. B.: Geology of Roche Miette Map-Area, Jasper Park, Alberta; Geol. Surv., Canada, Sum. Rpt. 1911, pp. 113-124, 1924.

2. Irish, E. J. W.: Pedley Map-Area, Alberta; Geol. Surv., Canada, Paper 45-13, 1945.

3. ————: Gregg Lake Map-Area, Alberta; Geol. Surv., Canada, Paper 46-4, 1946.

4. Lang, A. H.: Entrance Map-Area, Alberta; Geol. Surv., Canada, Paper 45-11, 1945.

5. ————: Brûlé Map-Area, Alberta; Geol. Surv., Canada, Paper 46-5, 1946.

6. ————: Moberly Creek Map-Area, Alberta; Geol. Surv., Canada, Paper 47-11, 1947.

7. ————: Entrance and Brûlé Map-Area, Alberta; Geol. Surv., Canada, Mem. 244, 1947.

8. MacKay, B. R.: Brûlé Mines Coal Area, Alberta, Geol. Surv., Canada, Sum. Rpt. 1928, pt. B, pp. 1-29, (1929).

9. MacVicar, J.: Foothills Coal Areas North of the Grand Trunk Pacific Railway, Alberta; Geol. Surv., Canada, Sum. Rpt. 1916, pt. C, pp. 85-93, (1917).

10. McEvoy, J.: The Smoky River Coal Field, Alberta; The Dominion Fuel Board in co-operation with the Geol. Surv., Canada, 1925.

VITA

The writer was born in Luton, Bedfordshire, England, on December 23, 1912. He came to Vancouver, Canada, in 1919, and received his elementary and high school education in the public schools of the Municipality of West Vancouver. Following this, he entered the University of British Columbia, graduating with the degree of Bachelor of Arts in May, 1939. In May, 1940, he received the degree of Master of Arts in geology from the same institution. From October, 1940 until May, 1943, he attended the University of Toronto, Toronto, Ontario, and served as an Assistant in the Department of Geology while engaged in graduate studies. In October, 1946, he entered the Graduate School of the University of Illinois to continue graduate studies in geology.

From 1935 until 1943 he was employed for summer field work by the Geological Survey, Canada, and since October, 1943, has held the position of geologist on the staff of the Geological Survey, Canada.

The writer's publications are as follows:

1. Some Coal Deposits of the Peace River District; Geol. Surv., Canada, Paper 44-15, 1944. In collaboration with F. H. McLearn.
2. Pedley Map-Area, Alberta; Geol. Surv., Canada, Paper 45-13, 1945.
3. Gregg Lake Map-Area, Alberta; Geol. Surv., Canada, Paper 46-4, 1946.
4. Pierre Grey's Lakes Map-Area, Alberta; Geol. Surv., Canada, Paper 48-7, 1948. In collaboration with A. H. Lang.

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